Impact of cognitive load and frustration on drivers' speech. Hynek Bořil (Erik Jonsson School of Engineering and Comp. Science, The Univ. of Texas at Dallas, 2601 N. Floyd Rd. 75080, Richardson, TX 75083-0688, hynek@utdallas.edu), Tristan Kleinschmidt (Speech and Audio Research Lab., Queensland Univ. of Technology, GPO Box 2434, Brisbane, QLD, 4001, Australia), Pinar Boyraz, and John, H. L. Hansen (Erik Jonsson School of Engineering and Comp. Science, The Univ. of Texas at Dallas, 2601 N. Floyd Rd. 75080, Richardson, TX 75083-0688)

Secondary tasks such as cell phone calls or interaction with automated speech dialog systems (SDS) increase the driver's cognitive load as well as the probability of driving errors. This study analyzes speech production variations due to cognitive load and emotional state of drivers in real driving conditions. Speech samples were acquired from 24 female and 17 male subjects (approximately 8.5 hours of data) while talking to a co-driver and communicating with two automated call centers, with emotional states (neutral, negative) and the number of necessary SDS query repetitions also labeled. A consistent shift in a number of speech production parameters (pitch, first format center frequency, spectral center of gravity, spectral energy spread, and duration of voiced segments) was observed when comparing SDS interaction against co-driver interaction; further increases were observed when considering negative emotion segments and the number of requested SDS query repetitions. A mel frequency cepstral coefficients based Gaussian mixture classifier trained on 10 male and 10 female sessions provided 91% accuracy in the open test set task of distinguishing co-driver interactions from SDS interactions, suggesting – together with the acoustic analysis – that it is possible to monitor the level of driver distraction directly from their speech.

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